

CLAIMS:

1. An air-fuel ratio control apparatus for controlling an air-fuel ratio of an air-fuel mixture to be supplied to an internal combustion engine having a plurality of cylinders so that the air-fuel ratio coincides with a target air-fuel ratio, said air-fuel ratio control apparatus comprising:

an air-fuel ratio sensor provided at a position downstream of a joining portion of an exhaust manifold connected to said plurality of cylinders, said air-fuel ratio sensor for detecting an air-fuel ratio in exhaust;

identifying means for identifying at least one model parameter of a controlled object model defined by a relation between the air-fuel ratio detected by said air-fuel ratio sensor and a fuel supply amount parameter that specifies a fuel supply amount to each cylinder of said engine, the at least one model parameter being identified corresponding to each cylinder of said engine; and

air-fuel ratio difference determining means for determining a degree of differences between air-fuel ratios of air-fuel mixtures to be supplied to said plurality of cylinders, according to the at least one model parameter identified by said identifying means.

2. An air-fuel ratio control apparatus according to claim 1, wherein said air-fuel ratio difference determining means determines the degree of the differences according to the at least one model parameter identified when a predetermined engine operating condition is satisfied.

3. An air-fuel ratio control apparatus according to claim 1, wherein said air-fuel ratio difference determining means calculates a difference evaluation parameter according to the at least one model parameter and determines the degree of the differences according to a value obtained by a statistical process of the difference evaluation parameter.

4. An air-fuel ratio control apparatus according to claim 3, wherein the statistical process is performed using a sequential algorithm.

5. An air-fuel ratio control apparatus according to claim 1, wherein the fuel supply amount parameter is a correction coefficient of the fuel supply amount to be supplied to each cylinder of said engine.

6. A method for controlling an air-fuel ratio of an air-fuel mixture to be supplied to an internal combustion engine having a plurality of cylinders so that the air-fuel ratio coincides with a target air-fuel ratio, said air-fuel ratio control method comprising the steps of:

a) detecting the air-fuel ratio by an air-fuel ratio sensor provided at a position downstream of a joining portion of an exhaust manifold connected to said plurality of cylinders;

b) identifying at least one model parameter of a controlled object model defined by a relation between the detected air-fuel ratio and a fuel supply amount parameter that specifies a fuel supply amount to each cylinder of said engine, the at least one model parameter being identified corresponding to each cylinder of said engine; and

c) determining a degree of differences between air-fuel ratios of air-fuel mixtures to be supplied to said plurality of cylinders, according to the at least one identified model parameter.

7. An air-fuel ratio control method according to claim 6, wherein the degree of the differences is determined according to the at least one model parameter identified when a predetermined engine operating condition is satisfied.

8. An air-fuel ratio control method according to claim 6, wherein a difference evaluation parameter is calculated according to the at least one model parameter and the degree of the differences is determined according to

a value obtained by a statistical process performed on the difference evaluation parameter.

9. An air-fuel ratio control method according to claim 8, wherein the statistical process is performed using a sequential algorithm.

10. An air-fuel ratio control method according to claim 6, wherein the fuel supply amount parameter is a correction coefficient of the fuel supply amount to be supplied to each cylinder of said engine.

11. A computer program for causing a computer to carry out a method for controlling an air-fuel ratio of an air-fuel mixture to be supplied to an internal combustion engine having a plurality of cylinders so that the air-fuel ratio coincides with a target air-fuel ratio, said air-fuel ratio control method comprising the steps of:

a) detecting the air-fuel ratio by an air-fuel ratio sensor provided at a position downstream of a joining portion of an exhaust manifold connected to said plurality of cylinders;

b) identifying at least one model parameter of a controlled object model defined by a relation between the detected air-fuel ratio and a fuel supply amount parameter that specifies a fuel supply amount to each cylinder of said engine, the at least one model parameter being identified corresponding to each cylinder of said engine; and

c) determining a degree of differences between air-fuel ratios of air-fuel mixtures to be supplied to said plurality of cylinders, according to the at least one identified model parameter.

12. A computer program according to claim 11, wherein the degree of the differences is determined according to the at least one model parameter identified when a predetermined engine operating condition is satisfied.

13. A computer program according to claim 11, wherein a difference evaluation parameter is calculated according to the at least one model parameter and the degree of the differences is determined according to a value obtained by a statistical process performed on the difference evaluation parameter.

14. A computer program according to claim 13, wherein the statistical process is performed using a sequential algorithm.

15. A computer program according to claim 11, wherein the fuel supply amount parameter is a correction coefficient of the fuel supply amount to be supplied to each cylinder of said engine.

16. A motorized vehicle comprising:
an internal combustion engine having a plurality of cylinders;
an exhaust manifold connected to the plurality of cylinders; and
an air-fuel ratio control apparatus configured to control an air-fuel ratio of an air-fuel mixture to be supplied to the internal combustion engine so that the air-fuel ratio coincides with a target air-fuel ratio, said air-fuel ratio control apparatus comprising:

an air-fuel ratio sensor provided at a position downstream a joining portion where the exhaust manifold is connected to the plurality of cylinders, said air-fuel ratio sensor for detecting an air-fuel ratio of exhaust;

identifying means for identifying at least one model parameter of a controlled object model defined by a relation between the air-fuel ratio detected by said air-fuel ratio sensor and a fuel supply amount parameter that specifies a fuel supply amount to each cylinder of said engine, the at least one model parameter being identified corresponding to each cylinder of said engine; and

air-fuel ratio difference determining means for determining a degree of differences between air-fuel ratios of air-fuel mixtures to be supplied to said plurality of cylinders, according to the at least one model parameter identified by said identifying means.